

## ABSTRACT

Polarization independent optical isolator/circulator devices based on Mach-Zehnder interferometers. The devices utilize either polarization splitting and nonreciprocal polarization conversion or nonreciprocal phase shift within the interferometric arm. For devices with nonreciprocal phase shift, the relative phase difference is  $0^\circ$  in the forward propagation direction and  $180^\circ$  in the backward propagation direction, or vice versa, so that light goes into a bar or cross port depending on the propagation direction. The devices have advantages over previous designs in the use of inexpensive device components, simple alignment, minimal space requirement, and negligible polarization mode dispersion or polarization dependent loss. In addition, the devices can be made in a waveguide form with minimal loss and with high fabrication ease. An additional phase compensator and/or a variable attenuator can be integrated in order to relax the fabrication tolerances.